

**MACF 401 (MAST 729/MAST 881), Sec. F**  
Mathematical & Computational Finance I  
*Winter 2023*

**Instructor:** Dr. C. Hyndman, Office: LB 921.15 (SGW), Phone: 514-848-2424, Ext. 5219  
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**Extraordinary Circumstances:** In the event of extraordinary circumstances and pursuant to the academic Regulations, the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the changes.

**Office Hours:** TBA.

**Class Schedule:** Tuesday-Thursday, 16:15-17:30 in H 544, SGW Campus.

**Behaviour:** All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the [Code of Rights and Responsibilities](#) which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

**Text:** *Stochastic Calculus for Finance I: The Binomial Asset Pricing Model*, by Steven Shreve, Springer, 2005. (Required).

**Outline:** This course is an introduction to mathematical and computational finance. The focus is on the general theory through a thorough study of Binomial Models. The topics covered include:

- The binomial no-arbitrage price model: one-period, multi-period;
- State prices: change of measure, Radon-Nikodym derivatives, capital asset pricing model; utility maximization and optimal investment
- European and American derivative securities: call and put options, stopping times; exotic derivative securities
- Random walks: first passage times, reflection principal; perpetual American put option
- Interest-rate derivatives: binomial model for interest rates, bonds, fixed income derivatives, forward measure; Ho-Lee and Black-Derman-Toy models
- Forward and Futures contracts
- Hedging: the Greeks, Delta hedging.
- Convergence of the Binomial Model to the Black-Scholes model. The Black-Scholes Formula
- Numerical methods
- Other topics (time permitting)

**Evaluation:** Weighted average of Assignments (35%), Midterm Examination (25%), and the Final Examination (40%).

You are expected to work independently on all Assignments and Exams.

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore attempt all assigned problems.

**Midterm Exam:** February 23rd, 2023 (during class 4:15-5:30 pm).

**Programming:** Some assignment problems will require programming. Students are encouraged to use an object oriented programming language such as C++ or Java for programming exercises on assignments, as these are the industry standards for Quantitative Finance. Python and R are also acceptable languages if students do not have previous experience in object oriented programming. If the University provides an appropriate online programming platform (such as Jupyter notebooks) students may be required to use this platform for programming exercises.

**Intellectual  
Property:**

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**Academic Integrity and the Academic Code of Conduct**

This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: [concordia.ca/students/academic-integrity](http://concordia.ca/students/academic-integrity)." [*Undergraduate Calendar, Sec 17.10.2*]

**Use of Zoom**

**Note: Zoom is included as an institutionally-approved technology. This means we have been assured of the privacy protections needed to use freely within the classroom)**

Zoom might be used in this course to facilitate learning at a distance. It may be used to record some or all of the lectures and/or other activities in this course. If you wish to ensure that your image is not recorded, speak to your instructor as soon as possible.

Also, please note that you may not share recordings of your classes and that the instructor will only share class recordings for the purpose of course delivery and development. Any other sharing may be in violation of the law and applicable University policies, and may be subject to penalties.